

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF MICHIGAN
SOUTHERN DIVISION

UNITED STATES OF AMERICA,

Plaintiff,

v.

DANIEL GISSANTANER,

Defendant.

Case no. 1:17-cr-130

Hon. Janet T. Neff
United States District Judge

Hon. Ray Kent
United States Magistrate Judge

BRIEF IN SUPPORT OF DEFENDANT'S
MOTION TO EXCLUDE DNA EVIDENCE

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NOW COMES the defendant, Daniel Gissantaner, by and through his attorney, Joanna C. Kloet, Assistant Federal Public Defender, and pursuant to Federal Rules of Evidence 702, 703, and 403, and all other applicable rules and authority, hereby moves the Court to exclude any evidence related to deoxyribonucleic acid (“DNA”) in this case, for the reasons set forth in his Motion and this Brief.

I. SUMMARY OF ARGUMENT

This case implicates important questions about the standards for the collection, analysis, and interpretation of DNA material. The reports from the Michigan State Police (“MSP”) forensic laboratory indicate that they determined that the firearm in this case contained a mixture of DNA from three individuals, one of whom the Government alleges is the defendant. The other individual contributors of DNA are unknown. The defendant, Daniel Gissantaner, resided at the home where the firearm was located, with at least three other adults (two females and one male, Cory Patton), and three children. The firearm was located by Battle Creek Police Department (“BCPD”) officers in a locked chest in Cory Patton’s bedroom.

The defendant seeks to suppress the DNA evidence for two reasons. First, the MSP reports contain a likelihood ratio (“LR”) to convey the results of the DNA analysis. The LR, generated by a probabilistic genotyping software program called STRMix, is a statistical estimate regarding the possibility that some of the DNA material found on the firearm belonged/s to Mr. Gissantaner, and not another individual. The LR created by STRMix in this case is unreliable because the program’s code relies upon information that is subjective and can vary to an impermissible degree depending on the individual analyst and laboratory. Furthermore, the evidence does not meet accepted standards for use of this program. Lastly, submission of these results to a jury would be unfairly prejudicial. This scientific evidence is inadmissible under Federal Rules of Evidence 702,

703, and 403, and the principles outlined by the United States Supreme Court in *Daubert v. Merrell-Dow Pharms. Inc.*, 509 U.S. 579 (1993), and its progeny.

Secondly, the results of the DNA analysis, including both the statistical estimates generated by STRMix and the results of the underlying DNA testing, should be excluded because the materials disclosed to the defense in discovery – including, but not limited to the chain of custody, police reports, and the content of the recordings from officers’ body cameras at the scene – taken together, call into question the integrity of the DNA testing results. The reports do not demonstrate that the collecting agency, the Battle Creek Police Department (“BCPD”), handled the evidence in accordance with necessarily stringent DNA collection policies. In fact, the discovery materials reveal a five-day gap in the chain of custody and an apparent admission by an officer of his mishandling of the DNA material during a search of Mr. Gissantaner’s home. Because DNA material can be easily transferred to objects even without direct contact, without a continuous and detailed chain of custody, the possibility of the transfer of Mr. Gissantaner’s DNA to the firearm cannot be eliminated. Correspondingly, the DNA test results, and the probabilities generated by the STRMix program that rely upon those results, are unreliable, prejudicial, and should be excluded. *See United States v. McFadden*, 458 F.2d 440, 441 (6th Cir. 1972), *United States v. Williams*, 640 Fed. Appx. 492 (6th Cir. 2016).

II. FACTUAL BACKGROUND

A. Summary of Incident

This case arises out of a September 25, 2015, dispute between next-door neighbors with regard to a shared driveway between XX Highland Avenue and XX Highland Avenue, in Battle Creek, Michigan. The evidence provided by the government in discovery indicates that after the Battle Creek Police Department responded to a call related to the argument, a firearm was found

inside a locked cedar chest in an upstairs bedroom at the residence where the defendant lived, in Battle Creek, Michigan.

The defendant, Daniel Gissantaner, resided at XX Highland Avenue with his wife, Lisa Deerman, her adult daughter Linsey, and Cory Patton, Linsey's boyfriend. Cory and Linsey's three minor children, two girls and a boy (aged 4, 5, and 6 years), also resided at the home, which was owned by Lisa Deerman.

Gary Rose, who had just moved in with Lisa Harvey next door, had parked a vehicle with a trailer in the driveway shared by the residents of the two houses. (Attachment 1, Photograph of shared driveway taken by defense counsel; Attachment 2, Battle Creek Police Department, Police Report 15-008424 ("BCPD Report"), pp 4, 9; Body Camera Recording of Officer Craig Kidney, MVR 200856 ("Kidney MVR 200856") at 04:40.) At about 9:00 p.m. on September 25, 2015, Mr. Gissantaner observed that Gary Rose had parked an automobile in the shared driveway of the homes. (Attachment 2, BCPD Report, p 4.) Gary Rose, who was sitting at the kitchen table with Lisa Harvey, saw Mr. Gissantaner through the window, and came outside to confront him. (Body Camera Recording of Officer Tom Wirebaugh, MVR 200295 ("Wirebaugh MVR 200295") at 01:40.) An argument ensued between the two over the fact that Gary Rose's truck was parked in the shared driveway. (Attachment 2, BCPD Report, p 4.) Lisa Harvey heard the exchange and called 911, stating that she was getting into a fight with the neighbor man and claiming that her neighbor had a gun. (Recording of First 911 Call ("911 Call 1"), at 00:12, 00:38; Attachment 2, BCPD Report, p 4.) During the call, Lisa Harvey can be heard continuing to yell at Mr. Gissantaner, telling him, "You're goin'," and that the police were on the way, and declaring that she had "had it" and that he "didn't run this street." (911 Call 1 at 0:39, 2:47.)

The 911 operator asked Lisa repeatedly where the gun was, but Lisa Harvey ignored the question. (911 Call 1 at 02:27, 02:52.) When the 911 operator asked Lisa Harvey directly if she had seen the gun, Lisa Harvey ignored the question. (911 Call 1 at 02:27.) When she was asked again, she replied, “He was putting his hands behind his back.” (911 Call 1 at 03:00.) Lisa Harvey then told the 911 operator she was hanging up and commanded, “You get the police here.” (911 Call 1 at 03:14.) After Lisa Harvey hung up, the 911 operator can be heard telling a colleague that Lisa Harvey refused to the answer her question, stating, “She said she did, then she didn’t.” (911 Call 1 at 03:40.) A few minutes later, officers from the Battle Creek Police Department were dispatched to the home. (Attachment 2, BCPD Report, p 4.)

When officers arrived, Mr. Gissantaner greeted them and was interviewed by BCPD Officer Tom Wirebaugh. (Kidney MVR 200856 at 00:45; Attachment 2, BCPD Report, p 4.) Because of the possibility of the presence of a handgun, Mr. Gissantaner was placed into handcuffs while the investigation continued. (Attachment 2, BCPD Report, p 4; Kidney MVR 200856 at 08:30.) Mr. Gissantaner denied having possessed a gun, and no weapon of any kind was found on his person. (Attachment 2, BCPD Report, p 9.) During the interview, Mr. Gissantaner stated that at one point during the argument, he had reached in his pocket for his phone. (Wirebaugh MVR 200295 at 03:40.) Officer Kidney asked Mr. Gissantaner if he was on parole, and Mr. Gissantaner replied, “yes,” and told Officer Kidney he could search the house if he wanted. (Wirebaugh MVR 200295 at 06:38; BCPD Report, p 5.)¹

At the scene, Lisa Harvey, Gary Rose, and Cory Patton were interviewed by Officer Wirebaugh. (Attachment 2, BCPD Report, p 4; Wirebaugh MVR 200295 at 01:30.) Upon being

¹ Upon information and belief, officers did not realize Cory Patton was inside the home until approximately 9:15 p.m., when Mr. Gissantaner advised them of the same after being informed he was being taken into custody. (Kidney MVR 200856 at 15:00.)

asked directly, Gary Rose stated that he “did not actually see a gun.” (Wirebaugh MVR 200295 at 3:05.) He told police that he (Gary Rose) “grabbed a pipe” during the argument. (Wirebaugh MVR 200295 at 03:00.) Similarly, according to the police report, Lisa Harvey “never saw a gun” either. (Attachment 2, BCPD Report, p 4.) Towards the end of the interview, Officer Wirebaugh informed Gary Rose and Lisa Harvey that “it’s gonna be tough for any kind of charges” because they saw no gun. (Wirebaugh MVR 200295 at 03:49.)

BCPD Officers Kilbourn, Tom Burke, Craig Kidney, and Sergeant Palmer searched the home. (Attachment 2, BCPD Report, p 5.) In an upstairs bedroom where Cory Patton and Linsey stayed, officers located a box of Remington .40 caliber cartridges and a magazine containing .45 caliber cartridges on a TV stand. (Body Camera Recording of Officer Burke, MVR 200859 (“Burke MVR 200859”) at 29:00; Attachment 2, BCPD Report, p 8.) Officers also located marijuana seeds, a grinder, a scale, and a bong in Cory Patton’s bedroom. (Body Camera Recording of Officer Long, MVR 200863 (“Long MVR 200863”) at 00:29; Burke MVR 200859 at 33:15.)

Sergeant Palmer asked Cory Patton if he was “gonna find a gun in here.” (Burke MVR 200859 at 33:50; Attachment 2, BCPD Report, p 9.) Officers also asked Cory Patton where the key was for the locked chest in his room, as “he was the only one with access to the chest.” (Attachment 2, BCPD Report, pp 8-9.) With his key, Cory Patton opened the locked cedar chest in his bedroom, which contained a semi-automatic .45 caliber pistol. (Attachment 2, BCPD Report, p 8.)

Cory Patton told the officers that that was not his gun and stated that he took the firearm from Mr. Gissantaner. (Burke MVR 200856 at 37:00; Attachment 2, BCPD Report, pp 8, 9, 11.) Cory claimed that he had taken the gun from Mr. Gissantaner, put it on the kitchen counter, and

then put it in the cedar chest. (Burke MVR 200859 at 37:35; Kidney MVR 200856 at 55:45.) An officer probed, “Did you secure the gun so your kids didn’t get the gun?” and Cory Patton agreed, stating “Yeah.” (Burke MVR 200856 at 37:05.) An officer then stated to Cory Patton, “you got into a situation where you’re trying to stop violence from happening,” and “you brought something up here secured it so your kids didn’t get it, I understand that, anybody else would understand that.” (Burke MVR 200859 at 39:15.)

Upon further questioning, Cory Patton informed the officers that he (Patton) was a convicted felon. (Kidney MVR 200856 at 01:00:09.) He admitted that Mr. Gissantaner did not have a key to the chest. (Burke MVR 200859 at 36:30.) Cory Patton also stated that the .40 caliber ammunition belonged to a different gun he (Cory Patton) had “a long time ago.” (Burke MVR 200859 at 37:45).

On the recording from the body camera worn by Officer Kidney, an unidentified officer can be heard remarking to another person, apparently another officer, about the type and value of the gun. (Kidney MVR 200856 at 58:23.) The unidentified officer then continues, “It’s a problem ‘cause I touched it and I moved it and I know Olsen always tells me, ‘If you find something, just leave it there.’” (Kidney MVR 200856 at 58:23.) That Officer Kidney touched the weapon was confirmed by another officer on the recording of the body camera worn by Officer Long. (Long MVR 200863 at 49:30.) Similarly, on Officer Long’s recording, another officer can be heard stating that he touched the gun with his flashlight. (Long MVR 200863 at 49:30.)

After Officer Wirebaugh contacted MDOC parole, he informed Mr. Gissantaner he would be taken into custody for “kind of like threatening them about their trailer” and “prowling around their house lookin’ in their windows.” (Wirebaugh MVR 200295 at 18:05.) The defendant was taken to Calhoun County Jail. (Attachment 2, BCPD Report, p 5.)

According to his report, BCPD evidence technician Officer Todd Rathjen went to the home and “photographed and collected” the gun. (Attachment 2, BCPD Report, p 10.) Officer Rathjen’s report indicates that upon arrival at the station later that evening, he removed the cartridges from the magazine of the gun.² (Attachment 2, BCPD Report, p 10.) Officer Rathjen’s report then states he “then” traveled to the Calhoun County Jail, where at approximately 7:00 p.m., he collected a buccal swab sample from Mr. Gissantaner’s cheek.³ (Attachment 2, BCPD Report, p 10).

The chain of custody produced by BCPD, however, states that the gun was collected by Officer Rathjen at 10:10 p.m. on September 25, 2015, and that the buccal swab sample was collected at 11:00 p.m. (Attachment 3, Battle Creek Police Department, Chain of Custody (“BCPD COC”).) In any case, neither Officer Rathjen’s report nor the chain of custody indicate how authorities handled the firearm or the DNA samples at the respective sites of collection or during transportation to the station, or how they were stored. Officer Rathjen did not process and submit into property the firearm, the magazine, or the buccal (cheek) swab at the BCPD laboratory until five days later, on September 30, 2015. (Attachment 3, BCPD COC.; Attachment 2, BCPD Report, p 10.) No information exists with respect to the location of the ammunition, the firearm, or the swab taken from Mr. Gissantaner’s cheek for the period from September 25, 2015, to September 30, 2015.

The chain of custody document prepared by MSP indicates that on October 2, 2015, the MSP laboratory received from the BCPD, via hand-delivery, two items: a container containing the

² The photographs submitted in this matter, ostensibly taken by Officer Rathjen at the scene on September 25, 2015, show an open cedar chest containing the firearm in question and a magazine outside of the firearm on top of a pile of clothing in Cory Patton’s room.

³ Officer Rathjen’s report stated he collected the buccal swab from Mr. Gissantaner at 7:00 p.m. However, according to the 911 CAD report, the initial 911 call was not placed until 8:57 p.m. (CAD Report.)

gun swabs and a container containing the defendant's cheek swabs. (Attachment 4, Michigan State Police, Chain of Custody ("MSP COC").) The reports prepared by MSP provided to the defense show that the items were forwarded to the MSP Lansing Laboratory on or after January 29, 2016 and that the analysis of these items began on May 16, 2016. (Attachment 5, Michigan State Police, Worksheet, May 16, 2016 ("MSP Worksheet"); Attachment 6, Michigan State Police, Notes ("MSP Notes"); Attachment 7, Michigan State Police, Report 1 ("MSP Report 1").) On May 27, 2016, MSP issued a report stating that the DNA results on the firearm showed a mixture of multiple contributors and therefore needed further analysis. (Attachment 8, Michigan State Police, Report 2 ("MSP Report 2").)

On June 2, 2016, MSP began an analysis of the DNA test results using STRMix software, a probabilistic genotyping software application.⁴ (Attachment 9, Michigan State Police, STRMix Reports.) MSP issued a follow-up report on June 10, 2016, which stated:

Based on the DNA typing results obtained, it is at least 49 Million times more likely if the observed DNA profile from the swabs of textured areas of GUN-001 originated from Daniel Gissantaner and two unrelated, unknown contributors than if the data originated from three, unrelated, unknown individuals.

Attachment 10, Michigan State Police, Report 3 ("MSP Report 3").

According to the STRMix reports, the major contributor contributed 68% of the DNA in the sample, the first minor contributor contributed 25%, and the next minor contributor contributed 7% of the sample. (Attachment 9, MSP STRMix Report.) Approximately 7.96 ng of total DNA was extracted from the sample, and 1.3 ng of that amount was male DNA. The defense's DNA

⁴ On February 22, 2016, MSP confirmed that internal validation studies on STRMix had been performed by MSP, indicating that MSP had just started using the software program a few months earlier. (Attachment 14, Michigan State Police, STRMix Validation Summary, 02/22/2016 ("MSP STRMix Validation Summary"), p 1.) The Federal Bureau of Investigation ("FBI") laboratory began using the STRMix program in December 2015. (PCAST, p 79.)

expert has concluded that the information contained in the materials provided by MSP indicate that Mr. Gissantaner, a male, is a minor contributor, and may correspond to the 7% contributor.

The MSP chain of custody indicates that the swabs from the gun and the buccal swabs from Mr. Gissantaner were returned to BCPD on March 8, 2016. (Attachment 4, MSP COC.) The BCPD chain of custody document indicates these materials were received and placed into long-term storage on March 9, 2016. (Attachment 3, BCPD COC.) The MSP chain of custody also indicates that the DNA extract from the gun swab and the DNA extract from Mr. Gissantaner were returned to BCPD on July 13, 2016. (Attachment 4, MSP COC.) On October 2, 2017, undersigned counsel and her investigator visited the BCPD station to view the evidence. The evidence presented to defense counsel included an envelope labeled as containing “2 buccal swabs” taken “from textured areas” of the gun, which contained two long swab sticks with cotton tips; an envelope labeled as containing “DNA FROM MSP” with a small capsule ostensibly containing the swabs with DNA extract from the textured areas of the gun; and an envelope labeled as containing DNA FROM MSP” with a small capsule ostensibly containing the swabs with the DNA extract from the buccal swabs of Mr. Gissantaner. (Attachment 11, Photographs of evidence taken by the defense, 10/02/17.) However, long swab sticks from Mr. Gissantaner’s cheek sample were not present. Thus, the precise location of Mr. Gissantaner’s cheek swabs are unclear or unknown.

B. Summary of DNA Analysis

Modern DNA testing focuses on specific places, called “loci,” of the human genome containing “Short Tandem Repeats, or STRs, which are genetic markers that contain short repeated sequences of DNA base pairs.” (Attachment 12, Michigan State Police Biology Procedures and Training Manuals (“MSP PMBIO”), 2.11.1.) The number of times that a particular sequence

repeats itself at a locus varies from person to person, such that STR “represent a good source to differentiate individuals.” (Attachment 12, MSP PMBIO 2.11.1.)

STR are detected through a process using polymerase chain reaction (“PCR”) and an analytical technique called capillary electrophoresis. (Attachment 12, MSP PMBIO 2.11.1.) During PCR, the DNA sample is copied, or “amplified,” utilizing commercially-produced fluorescent primers. (Attachment 12, MSP PMBIO 2.11.1.) The genetic material then is passed through a capillary electrophoresis instrument, which “separates the DNA fragments by size” for identification. (Attachment 12, MSP PMBIO 2.11.1.) The number of times that a particular sequence repeats at a particular site corresponds to an “allele.” (Attachment 12, MSP PMBIO 2.11.1.) Following electrophoresis, a graph called an electropherogram (“EPG”) is generated, wherein the peaks are proportionate to the amount of DNA present. (Attachment 12, MSP PMBIO 2.11.1.; Attachment 13, Michigan State Police, Electropherograms (“MSP EPGs”), dated May 22, 2016 and June 2, 2016.

Here, the materials provided by MSP to the defense indicate that the DNA contained in the swab of the firearm consisted of three contributors.⁵ (Attachment 8, MSP Report 2.) The majority of the DNA was female. (*See* Attachment 5, MSP Worksheet.) The analysis focused on 23 loci, 17 of which contained alleles that matched those of Mr. Gissantaner’s sample. (Attachment 13, MSP EPG, May 22, 2016 (DNA extract from swabs of gun).) No information was provided to the defense with respect to the identity of the other contributors of the DNA on the weapon.

⁵ MSP’s policy manual requires consideration of multiple donors when several situations are observed, including, but not limited to the observation of more than two interpretable alleles in at least two autosomal loci. PMBIO 2.10.7.2.

C. Use of statistical software programs to attribute meaning to the results of DNA testing

With the evolution of PCR, a “broader range of evidentiary samples have become eligible for testing.” (Attachment 14, MSP STRMix Validation Summary, p 3.)⁶ However, the heightened sensitivity of DNA testing means that MSP has “seen a significant increase in the number of DNA samples with multiple contributors, artifacts, stochastic events, allelic drop in/out and other factors that must be considered during DNA profile interpretation.” (Attachment 14, MSP STRMix Validation Summary, p 3.)

On February 22, 2016, MSP published the results of its internal validation testing on STRMix.⁷ (Attachment 14, MSP STRMix Validation Summary, p 3.) STRMix is a software program that generates a statistical estimate called a likelihood ratio (“LR”) to communicate the laboratory’s “assessment of how strongly forensic evidence can be tied to a suspect.” (Attachment 15, Article, National Institute of Standards and Technology, “NIST Experts Urge Caution in Use of Courtroom Evidence Presentation Method,” October 12, 2017; *see also* Attachment 14, MSP STRMix Validation Summary, p 4.) The LR “considers the probability of obtaining the evidence profile(s) given two competing propositions, usually aligned with the prosecution case and defence case.” (Attachment 16, “Developmental validation of STRMix, expert software for the interpretation of forensic DNA profiles,” *Forensic Science International: Genetics* 23 (2016) 226-239 (“FSI 23”), p 226.) To generate an LR in a case, the individual laboratory chooses two hypotheses. The first hypothesis is characterized as a prosecution fact – in this case, that the

⁶ The PCR process makes it “possible to detect DNA at levels hundreds or even thousands of times lower than when DNA fingerprinting was developed in the 1980s.” (Article, *Science Magazine*, “Forensics gone wrong: When DNA snares the innocent,” by Douglas Starr, March 7, 2016, p 3.)

⁷ To establish the parameters for STRMix, the MSP laboratory collected data from its three individual laboratory locations and selected all the settings from the one it determined to be most representative of the three. (MSP STRMix Validation Summary, pp 5, 19.)

defendant's DNA and the DNA of two unknown individuals are present on the weapon. (Attachment 14, MSP STRMix Validation Summary, p 4; Attachment 10, MSP Report 3.) The second hypothesis is a defense hypothesis – that the material contains the DNA of three unrelated persons, not the defendant. (Attachment 14, MSP STRMix Validation Summary, p 4; Attachment 10, MSP Report 3.) In essence, an LR represents the likelihood of whether a particular person's DNA is present in a mixture, as compared to a random person's DNA, based on standard reference databases. However, due to the statistical methodology used in STRMix, "[t]he results of no two analyses will be completely the same." (Attachment 16, FSI 23, p 232.)

STRMix uses the information from the electropherogram "to calculate the probability of the profile given all possible genotype combinations." (Attachment 16, FSI 23, p 227.) The program "assigns a relative weight to the probability of the [electropherogram] given each possible genotype combination at a locus, and the weights across all combinations at that locus are normalized so that they sum to one. (Attachment 16, FSI 23, p 227.) However, several factors entered into the STRMix program are under the control of the operator or the individual laboratory, and thus are variable. (Attachment 16, FSI 23, p 231.)

For instance, although "[t]he true number of contributors to a profile is always unknown," (Attachment 16, FSI 23, p 233), the individual analyst determines the number of contributors to a DNA profile. (Attachment 12, MSP PMBIO 2.11.8; *see also* Attachment 14, MSP STRMix Validation Summary, p 4.) MSP's policies characterize the determination of the number of contributors as an estimate, based on "the overall quality of the electropherogram, the locus with the greatest number of interpretable alleles, the peak height of alleles within a locus and the presence of possible alleles below the Analytical Threshold[.]" (Attachment 12, MSP PMBIO 2.10.9.2.) The manual cautions that "[s]tudies indicate it is difficult to determine with certainty

the actual number of donors to any given mixture, especially as the number of donors increases.” (Attachment 12, MSP PMBIO 2.10.9.2.)

In addition to the number of contributors, the STRMix program relies upon other terms set by the individual laboratory, such as analytical thresholds,⁸ stutter ratios,⁹ drop-in rates,¹⁰ and saturation levels. (Attachment 12, MSP PMBIO 2.11.8; Attachment 16, FSI 23, p 231; Attachment 14, MSP STRMix Validation Summary, p 18.) Furthermore, the amount of DNA tested “can have a dramatic impact on the quantity and quality of the STR results obtained,” and “the significance of the likelihood ratios are negatively impacted as the input DNA amount decreases and the extent of allelic and locus drop-out increases.” (Attachment 14, MSP STRMix Validation Summary, p 39.) In other words, not all profiles are suitable for STRMix application – MSP’s policies provide that “[p]rofiles exhibiting significant levels of allelic and/or locus drop-out of one or more of the contributors may not be suitable for analysis using STRMix.” (Attachment 12, MSP PMBIO 2.10.9; *see also* Attachment 12, PMBIO 2.11.7.) Because STRMix requires use of a numeric value for the allele, if an allele cannot be accurately assigned, then MSP’s policies instructs that “the entire locus shall be removed from the STRMix table and analysis.” (Attachment 12, MSP PMBIO 2.11.8.) However, if an allele is removed, MSP’s manual requires that statement to be included in the laboratory report. (Attachment 12, MSP PMBIO 2.11.8, p 116.)

⁸ The analytical threshold is a limit selected by the laboratory to distinguish “baseline or noise” from a true allelic peak. (MSP STRMix Validation Summary, p 5.)

⁹ Stutter is a phenomenon that is caused by miscopying in the PCR process.

¹⁰ “Drop-in is a non-reproducible, unexplained peak within a profile.” (MSP STRMix Validation Summary, p 11.)

III. THE “LIKELIHOOD RATIO” SHOULD NOT BE ADMITTED AS A TOOL TO CONVEY THE RESULTS OF DNA TESTING IN THIS CASE BECAUSE IT IS SUBJECTIVE, UNRELIABLE, AND HIGHLY PREJUDICIAL

A. The standard for admissibility of scientific evidence

The Federal Rules of Evidence (“FRE”) require a trial court judge to ensure that an expert’s testimony is both reliable and relevant before it may be admitted. *Daubert v. Merrell Dow Pharms. Inc.*, 509 U.S. 579 (1993) (evaluating plaintiffs’ expert’s testimony that ingestion of morning sickness pills manufactured by the defendant pharmaceutical company caused limb defects in the plaintiffs). FRE 702 grants the district court the discretionary authority to determine reliability and relevancy, given the particular facts and circumstances. *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999). This “gatekeeping” duty of the district court applies to all specialized knowledge, including, but not limited to technical and scientific knowledge. *Id.*; *see also Daubert, supra*, 509 U.S. at 589. The government must prove by a preponderance of the evidence to show scientific evidence is admissible. *Daubert, supra*, 509 U.S. at 592-93; *see also Bourjaily v. United States*, 483 U.S. 171, 174 (1987) (evidentiary admissibility determinations that hinge on preliminary factual questions must be established by the proponent of the evidence by a preponderance of the evidence).

To testify “in the form of an opinion or otherwise,” an expert witness first must be qualified based on her “knowledge, skill, experience, training, or education.” FRE 702. Once qualified, for the testimony to be admitted, the rule requires:

- (a) the expert’s scientific, technical, or other specialized knowledge must help the trier of fact to understand the evidence or determine a fact in issue;
- (b) the testimony is based on sufficient facts or data;
- (c) the testimony is the product of reliable principles and methods;

- (d) the expert must have reliably applied the principles and methods to the case.

FRE 702.

Expert opinion must be based on actual knowledge, not subjective belief or unsupported speculation. *Daubert, supra*, 509 U.S. at 590. Although an expert may base an opinion on facts if “experts in the particular field would reasonably rely on those kinds of facts or data in forming an opinion,” inadmissible facts or data may be disclosed to the jury “only if their probative value in helping the jury evaluate the opinion substantially outweighs their prejudicial effect.” FRE 703. Finally, even relevant evidence must be excluded “if its probative value is substantially outweighed” by the possibility of unfair prejudice, confusion of the issues, misleading of the jury, undue delay, wasting time, or needlessly presenting cumulative evidence. FRE 403.

The Supreme Court in *Daubert* set forth factors for a court to evaluate in determining the admissibility of scientific or expert testimony:

- (1) whether the expert’s theory or technique can, or has been, tested;
- (2) whether the theory or technique has been subjected to peer review and publication;
- (3) the known or potential rate of error of the technique or theory for a particular scientific technique and the existence and maintenance of standards controlling the technique’s operation; and
- (4) whether the theory or technique is generally accepted in the relevant scientific community.

Daubert, supra, 509 U.S. at 593-94.

However, no single factor alone is necessarily dispositive, and other factors may be relevant. *See id.* at 593; *see also Kumho Tire, supra*, 526 U.S. at 149. The Court observed that subsection to scrutiny is a component of good science, in part because it increases the likelihood that substantive flaws in methodology will be detected. *Daubert, supra*, 509 U.S. at 593-94. “Widespread acceptance can be an important factor in ruling particular evidence admissible, and ‘[a] known technique that has been able to draw only minimal support within community may

properly be viewed with skepticism.” *Id.* at 594. Importantly, “[s]cientific conclusions are subject to perpetual revision,” and “[t]he scientific project is advanced by broad and wide-ranging hypotheses, for those that are incorrect will eventually be shown to be so[.]” *Id.* at 597.

“[N]othing in either *Daubert* or the [FRE] requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert. *General Electric Company v. Joiner*, 522 U.S. 136, 146 (1997). In *Joiner*, the respondent sought to admit the testimony of expert witnesses who testified that they believed his exposure to certain materials in the workplace were “causally linked to” or “contributed to in a significant way” his cancer. *Id.* at 143. However, the district court refused to admit the evidence, finding that the reports upon which *Joiner*’s experts had relied involved “isolated studies of laboratory animals” – namely, infant mice – who had had massive doses of the chemicals injected directly into their bodies. *Id.* at 143. Further, the Court observed, the cancer in the mice and in *Joiner* were different. *Id.* at 144. Finally, the results of two of the four epidemiologic studies offered by the plaintiff were not “statistically significant,” and the remaining two studies involved different chemicals than those at issue in the case. *Id.* at 145-46. The Supreme Court observed that while “[t]rained experts commonly extrapolate from existing data,” in *Joiner*, the analytical gap between the data and the opinion proffered was simply too great. *Id.* at 147.

Finally, a district court has broad discretion to ensure that evidence is presented to the jury in an effective and efficient manner. *See* FRE 611(a). A trial results in a “binding legal judgment—often of great consequence—about a particular set of events in the past.” *Daubert, supra*, 509 U.S. at 597. The rules of evidence apply with equal force to questions of admissibility in criminal cases, where the consequence at stake is a wrongful conviction and attendant

sentence.¹¹ Although “[v]igorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence,” *id.* at 596, sometimes, clear effective presentation to the jury will be impossible.

Nearly 25 years ago, the Sixth Circuit upheld the admission of a different type of DNA evidence, finding that in that case, the principles and methodology used by the FBI to declare matches and make statistical probabilities were scientifically valid. *United States v. Bonds*, 12 F.3d 540, 563-64 (6th Cir. 1993). In *Bonds*, the FBI compared the results of a blood sample found in a vehicle used in a crime with a sample taken from the defendant, John Ray Bonds. *Id.* at 549. The DNA sample, comprised of a single contributor, was subjected to a type of testing called restriction fragmentation length polymorphism (“RFLP”) in use in 1989.¹² *Id.* at 550.

Based upon the results of the RFLP procedure, the FBI’s report stated that Bonds’ blood was a match to the blood found by investigators. *Id.* at 551. The FBI then made a statistical estimate of the rarity of the pattern of the DNA bands in the suspect’s sample, using the existing FBI database of approximately 225 persons. *Id.* at 550-51. This methodology involved calculating the relative frequencies of each allele that appears in the defendant’s profile, and then multiplying them together under the product rule, which in turn generates an estimate of the probability that a person picked randomly from the general population would have an identical profile to the one identified in the sample. *Id.* at 550. The FBI in *Bonds* ultimately calculated a probability of 1 in

¹¹ For a survey of jurisprudential trends in the denial of criminal defendants’ post-*Daubert* challenges to prosecution evidence, including DNA evidence, *see* Risinger, D. Michael, “Navigating Expert Reliability: Are Criminal Standards of Certainty Being Left on the Dock?” 64 *Albany L. Rev.* 99, 125-28 (2000).

¹² RFLP was a process which isolated and analyzed certain regions of the human genome known as variable number tandem repeats (“VNTR”). *Id.* at 550. The DNA was separated by size by a procedure known as gel electrophoresis, and using X-ray technology, the results were transferred into a film that was interpreted by a technician visually or with the assistance of computer imaging to compare DNA band patterns from known and unknown samples. *Id.* at 550.

35,000 that an unrelated individual, randomly selected from the Caucasian population, would have a DNA profile matching that of Bonds and the sample. *Id.* at 551. Bonds was convicted. *Id.* at 552.

The Sixth Circuit characterized Bonds’ argument on appeal as a challenge to the “methodology of performing comparative testing [using VNTR analysis] and calculating the statistical probabilities of a ‘match.’” *Id.* at 558. The Court viewed Bonds’ challenge as one direct toward the *precision* of the probability estimate made by the FBI. *Id.* at 558. The Court focused on the *Daubert* requirement that the court make “a preliminary assessment of the proffered testimony . . . to determine whether the principles, methodology, and reasoning underlying the testimony are scientifically valid.” *Id.* at 558.

With respect to the first *Daubert* requirement – that is, whether the theory or technique can be and has been tested – the Court noted internal proficiency tests and validation tests performed by the FBI, and ultimately concluded this factor was “not really in dispute” by the defense. *Id.* at 558-59. The Court observed that, given the defense’s presentation “of evidence about deficiencies in both the results and the testing of the results . . . [t]he dispute between the Government and the defendants is over *how* the results have been tested, not over *whether* they have been tested.” *Id.* at 559.

Next, the Court determined that “peer review” factor was also met. *Id.* at 559-60, 563-64. Qualifying that “publication is but one element of peer review,” *id.* at 564, the Court determined that although the FBI’s procedures were not published in peer-reviewed journals, the procedures “certainly have received at least some exposure within the scientific peerage to which they belong.” *Id.* at 559-60, 563-64 (internal citations omitted). The Sixth Circuit conceded that it found “troubling” the deficiencies in calculating the rate of error in the FBI’s methodology, noting

both the “serious deficiencies” in the internal proficiency tests and the failure to conduct external blind proficiency tests. *Id.* at 560. Nonetheless, the Court concluded that error rate “is only one in a list of nonexclusive factors that the *Daubert* Court observed would bear on the admissibility question,” and furthermore, “because the magistrate judge’s findings underlying general acceptance encompass the existence and maintenance of standards controlling the technique’s operations, it is implicit that the rate of error is acceptable to the scientific community as well.” *Id.* at 560 (internal citations omitted).

The Court acknowledged that the defendant had presented expert testimony that “the FBI’s methods were flawed because they did not take into account ethnic substructure,” but dismissed this testimony because “the defense witnesses could only speculate about the effect of ethnic substructure because there is no positive evidence that ethnic substructure exists.” *Id.* at 564. The Court held this argument went to the accuracy of the results, and agreed with the lower court that “the DNA results were based on scientifically valid principles and derived from scientifically valid procedures.” *Id.* at 564. Although it echoed the magistrate judge’s finding that although “an absence of consensus is not immaterial,” the Court rejected the defense’s contention that a consensus is required as a red herring, *id.* at 562, finding it “not dispositive that there are scientists who vigorously argue that the probability estimates are not accurate or reliable because of the possibility of ethnic substructure.” *Id.* at 564. Ultimately, the Court found that “the underlying principles and methodology used by the FBI to declare matches and make statistical probabilities are scientifically valid” in that it “resulted from sound and cogent reasoning” that was based on more than speculation or subjective belief. *Id.* at 565.

Notably, however, the Court of Appeals had refused to consider a major piece of scientific research questioning several of the FBI’s DNA testing procedures. *Id.* at 552. In 1992, while

Bonds' conviction was pending appeal, the National Research Committee ("NRC") of the National Academy of Sciences ("NAS") had issued a report that contended that the FBI's method of multiplying the frequency of the alleles at each site "distorts the probability estimates because the rule [did] not take into account the possibility of 'population substructure,' or a view that racial populations contain ethnic subpopulations that have distinct DNA allele frequencies." *Id.* at 552. The defense had requested the appeals court take judicial notice of this report, arguing that had the method proposed by the NRC report to perform probability calculations to compensate for population substructure, the probability of Bonds' DNA pattern being found in the Caucasian population would be 1 in 17. *Id.* at 552. However, prior to engaging in its substantive analysis under *Daubert*, the Court granted the government's motion to strike the report, rationalizing that because it was not a part of the record below, it would constitute improper fact-finding by an appellate court. *Id.* at 552-53. The report had been published a year after Bonds was convicted.¹³ *Id.* at 552-53.

B. The LR generated by MSP's application of STRMix does not meet the standards for admission of scientific evidence set forth by the FRE and applicable case law because the underlying methodology is not scientifically valid.

Modern forensic DNA analysis was an issue tackled in a September 2016 report to the President by his Council of Advisors on Science and Technology, or PCAST.¹⁴ PCAST was tasked with determining whether additional steps should be taken, "beyond those already taken by the Administration in the aftermath of a highly critical 2009 National Research Council report on the

¹³ In 1996, the NRC issued a second report that set forth procedures for taking different subgroups into account in computing "random-match probabilities for an incriminating DNA profile in a population or a subgroup of a population." (Attachment 24, The Second National Research Council Report on Forensic DNA Evidence ("NRC II").)

¹⁴ President's Council of Advisors on Science and Technology, Report to the President, "Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods" ("PCAST Report"), located at https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf (last accessed Dec. 15, 2017).

state of the forensic sciences, that could help ensure the validity of forensic evidence used in the Nation's legal system.”¹⁵ The report offers recommendations to the National Institutes of Standards and Technology (“NIST”), the White House, the FBI, the Attorney General, and the judiciary on “actions that could be taken to strengthen forensic science and promote its rigorous use in the courtroom.”¹⁶

The 2016 PCAST report acknowledged the well-settled proposition that “DNA analysis of a sample from *a single individual* is an objective method,” observing that the laboratory protocols in single-source analysis are precisely defined and that the interpretation “involves little or no human judgment.” (Attachment 17, PCAST Report, pp 7, 70, 71 (emphasis added).)¹⁷ However, the Council observed, “[a]s DNA testing kits have become more sensitive, there has been growing interest in ‘touch DNA’ – for example, tiny quantities of DNA left by *multiple individuals* on the steering wheel of a car.” (Attachment 17, PCAST Report, p 75 (emphasis added).) The report explained that “the fundamental difference” between analysis of *complex mixtures*, versus single source and simple mixtures (the latter of which is defined as two contributors), lies *in the interpretation of the resulting DNA profile*. (Attachment 17, PCAST Report, pp 7, 75 (emphasis added).)

The report states:

Interpreting a mixed profile is different for multiple reasons: each individual may contribute two, one or zero alleles at each locus; the alleles may overlap with one another; the peak heights may differ considerably, owing to differences in the amount and state of preservation of the DNA from each source; and the “stutter peaks” that surround alleles (common artifacts of the DNA amplification

¹⁵ The White House Blog, “PCAST Releases Report on Forensic Science in Criminal Courts,” located at <https://obamawhitehouse.archives.gov/blog/2016/09/20/pcast-releases-report-forensic-science-criminal-courts> (last accessed Dec. 15, 2017).

¹⁶ PCAST Report, located at <https://obamawhitehouse.archives.gov/blog/2016/09/20/pcast-releases-report-forensic-science-criminal-courts> (last accessed Dec. 15, 2017).

¹⁷ Single-source samples utilize estimates of random match probability based on FBI DNA profiles from approximately 200 unrelated individuals from each of the six population groups. (PCAST, p 72.)

process) can obscure alleles that are present or suggest alleles that are not present. *It is often impossible to tell with certainty which alleles are present in the mixture or how many separate individuals contributed to the mixture, let alone accurately to infer the DNA profile of each individual.*

* * *

Because many different DNA profiles may fit within some mixture profiles, the probability that a suspect “cannot be excluded” as a possible contributor to complex mixture may be much higher (in some cases, millions of times higher) than the probabilities encountered for matches to single-source DNA profiles. As a result, *proper* calculation of the statistical weight is critical for presenting accurate information in court.

Attachment 17, PCAST Report, pp 75-76. (emphasis added).

The PCAST report then addressed probabilistic genotypic software programs like STRMix. (Attachment 17, PCAST Report, pp 78-79.) The Council cautioned that while these programs are a “major improvement over purely subjective interpretation,” they still require careful scrutiny regarding the validity of these scientific methods because “the programs employ different mathematical algorithms and can yield different results for the same mixed profile.”¹⁸ (Attachment 17, PCAST Report, pp 8, 79.) The Council noted that the two most widely-used methods, STRMix and TrueAllele, are commercial competitors and appear reliable only within a certain range – that is, according to the companies’ own studies, they appear to be reliable for three-person mixtures in which the DNA amount exceeds the minimum level required for the method and in which *the minor contributor constitutes at least 20 percent* of the intact DNA in the mixture. (Attachment 17, PCAST Report, p 80.) The Council urged “appropriate evaluation”

¹⁸ In a study by the NIST, 108 labs across the country to determine whether a separate DNA sample was part of the mix. Seventy-three of the labs got it wrong, saying the suspect’s DNA was part of the mix when, in fact, it was not. When dealing with a mix of DNA from various potential subjects, “too much is left to the analysts’ discretion.” As the NIST geneticist who set up the scenario observed, “it’s the Wild West out there.” (Douglas Starr, “Forensics gone wrong: When DNA snares the innocent,” Science Magazine, Mar. 7, 2016, p 5.)

of the proposed methods by multiple groups that are “*not associated with the software developers.*” (Attachment 17, PCAST Report, p 79 (emphasis in original).)

After the PCAST report was issued, on October 12, 2017, the National Institute of Standards and Technology (“NIST”), a non-regulatory agency of the United States Department of Commerce, released a study concluding that using the likelihood ratio (LR) in courtrooms is not consistently supported by scientific reasoning. (Attachment 15, NIST Article; Attachment 18, Lund, et. al, “Likelihood Ratio as Weight of Forensic Evidence: A Closer Look,” Journal of Research of National Institute of Standards and Technology, Vol. 122, Art. No. 27 (2017) (“NIST Study”)).¹⁹ The authors of the study, NIST statisticians Steve Lund and Hari Iyer, warn that the justification for using LR in courtrooms is flawed because it “risks allowing personal preference to creep into expert testimony and potentially distorts evidence for a jury.” (Attachment 15, NIST Article, p 2.)

Lund and Iyer explain that proponents of the LR approach appear to justify its use with Bayesian decision theory, “a reasoning approach that has long been used by the scientific community to create logic-based statements of probability.” (Attachment 18, NIST Study, p 2; Attachment 15, NIST Article, p 2.) Bayesian reasoning is “a structured way of evaluating and re-evaluating a situation as new evidence comes up.” (Attachment 15, NIST Article, p 2.) Essentially, under Bayes’ rule, “individuals multiply their previous (or prior) odds by their respective likelihood ratios to obtain their updated (or posterior) odds, reflecting their revised degrees of belief regarding the claim in question.” (Attachment 18, NIST Study, p 1.) Applying this approach allows an expert to come up with a logic-based numerical LR that makes sense to the expert *as an individual*. (Attachment 15, NIST Article, pp 2-3.)

¹⁹ Located at <https://doi.org/10.6028/jres.122.027> (last accessed Dec. 12, 2017).

However, Lund and Iyer argue, Bayesian reasoning “breaks down in situations where information must be conveyed from one person to another such as in courtroom testimony.” (Attachment 15, NIST Article, p 2.) The problem, they explain, is when jurors are told to incorporate the expert’s LR into their own decision-making, because an expert’s judgment often involves complicated statistical techniques that can and do generate different LRs, depending on the expert. (Attachment 15, NIST Article, p 3.) Lund and Iyer observe that “[c]omputing an LR for anything but the simplest of problems will involve approximations[,]” (Attachment 18, NIST Study, p 7), explaining that:

. . . reporting a single LR value after an examination of available forensic evidence *fails to correctly communicate* to the [decision maker] the information actually contained in the data. Personal choices strongly permeate every model.

Attachment 18, NIST Study, p 14. (emphasis added)

The authors warn that “Bayesian decision theory neither mandates nor proves appropriate the acceptance of a subjective interpretation of another, regardless of training, expertise, or common practice.” (Attachment 18, NIST Study, p 22.) Furthermore, although validation can demonstrate that a particular interpretation may be reasonable, “this should not be misunderstood to mean the model is accurate or authoritatively appropriate.” (Attachment 18, NIST Study, p 22.) While a decision maker “only needs to be personally satisfied regarding the suitability of using any given LR in Bayes’ formula, guiding the probabilistic interpretation of others [such as jurors] requires greater care.” (Attachment 18, NIST Study, p 7.) The authors argue that an extensive uncertainty analysis is critical for assessing when and how LRs should be used and recommend that *a probability-based model like LR is only warranted when evaluating high-quality samples of DNA from a single source.* (Attachment 15, NIST Article, p 2.) Lund and Iyer maintain that

for a technique to broadly apply, it must be based on measurements that can be *replicated*. (Attachment 15, NIST Article, p 2.)

Here, the methodology underlying the LR is not scientifically valid. The methodology fails, at a minimum, the second, third, and fourth prongs of *Daubert*.

First, with respect to an assessment of whether the theory or technique has been subjected to peer review and publication, the NIST report and the PCAST report both reveal that when subjected to scrutiny, the scientific community detected “substantive flaws in the methodology” of determining the LR. *Daubert, supra*, 509 U.S. at 593-94. In particular, the LR method impermissibly risks allowing personal preference to creep into expert testimony, “potentially distort[ing] evidence for a jury.” (Attachment 15, NIST Article, p 2.) As Lund and Iyer noted, “[p]ersonal choices strongly permeate every model” because using LR necessarily implicates an analyst’s judgment about whether to include certain data in the analysis, including the individual laboratory’s analytical thresholds, drop in/out, stutter, saturation, and an analyst’s assessment of the number of contributors. (Attachment 18, NIST Study, p 14.) Thus, as the NIST experts point out, an expert’s judgment, even when employing Bayesian reasoning correctly, can generate substantially different answers. (Attachment 15, NIST Article, p 3.) Indeed, MSP’s own internal procedures appear to recognize that inconsistent STRMix results are anticipated, by expressly counseling against repeating an STRMix analysis except in very limited situations.²⁰ (Attachment 12, MSP PMBIO 2.11.8, p 118.)

The factors incorporated into the STRMix program involve subjective interpretation, but as the NIST study points out, the decision-maker in this case (the individual juror) does not know the information actually contained in the data. (Attachment 18, NIST Study, p 14.) In fact, the

²⁰ If additional analyses are completed for a particular reason, the results must be either included in the case file and report or a notation must be made on the report that additional analyses were performed. (PMBIO 2.11.8, p 118.)

materials disclosed to the defense tend to indicate that potentially critical evidence was omitted here, in the discretion of the individual analyst. In particular, with respect to the analysis of the DNA found on the gun, the MSP analyst *disregarded* the data from one of the genetic loci (D8S1179), even though she conceded that the data indicated four, not three, contributors of DNA. (Attachment 13, MSP EPG, June 2, 2016). Instead, the analyst determined “oversaturation” was exhibited, and because this was a possible “artifact,” she dismissed the locus from the analysis. (Attachment 13, MSP EPG, June 2, 2016.) Importantly, according to MSP’s policy manual, when a peak height exhibits saturation, the sample should be re-run. (Attachment 12, MSP PMBIO 2.10.4.4.) However, there is no indication that was done here; rather, the information was simply discarded. Furthermore, another locus (D12S391), also tended to indicate the presence of four donors, as it appeared to show the presence of more than six alleles. (Attachment 13, MSP EPG, June 2, 2016.) However, the analyst nonetheless entered “three” as the number of contributors into the STRMix program, despite the fact that the possibility of four contributors had not been eliminated. (Attachment 13, MSP EPG, June 2, 2016.) This information was then entered into the STRMix program as a parameter relied upon by the STRMix program in generating the LR. (Attachment 9, Michigan State Police, STRMix Reports.)

More generally, the actual DNA material in this case was not suitable for subsection to STRMix analysis. The PCAST report observed that according to their own studies, STRMix and TrueAllele appear to be reliable for three-person mixtures in which the minor contributor constitutes *at least 20 percent of the intact DNA* in the mixture and in which the DNA amount exceeds the minimum level required for the method. (Attachment 17, PCAST, p 76.) Here, however, the major contributor contributed 68%, the first minor contributor contributed 25%, and the next minor contributor contributed only 7% of the sample. (Attachment 9, MSP STRMix

Report.) The defense’s expert concluded that the DNA in the sample was primarily female. Mr. Gissantaner, a male, was a minor donor to the sample, and was identified by the defense expert as possibly corresponding to the 7% minor donor. Thus, the contribution of the minor donor did not meet the 20% threshold specifically recommended by PCAST to the legal and scientific community to strengthen forensic science and “promote its rigorous use in the courtroom.” (Attachment 17, PCAST Report, p 76.)

With respect to the third prong of *Daubert*, meaningful standards controlling the operation of the technique do not exist, chiefly because STRMix is a proprietary program. *Daubert, supra*, 509 U.S. at 593-94. The standards for operation of the technique are not available to the MSP operators, because while MSP analysts are provided instructions on how to operate the commercial programs available to them, they are not expert statisticians qualified to offer testimony regarding the proprietary software’s internal calculus.²¹ The defendant’s inability to cross-examine a qualified STRMix software expert about the impact and basis for the program’s formulas, directions, and outcomes, would violate his Sixth Amendment right to confrontation. *See Crawford v. Washington*, 541 U.S. 36, 66-67 (2004). Furthermore, an MSP analyst’s testimony that she personally knows of the program’s uses in the field and that she has read papers where the programs were used is inadequate to establish that the application is reliable and cannot qualify her as an expert on STRMix software. While “[t]rained experts commonly extrapolate from existing data,” in a case involving complex statistical algorithms protected by patent, “too great an analytical gap” exists between the data and the opinion proffered. *Joiner, supra*, 522 U.S. at 147.

²¹ See Kirchner, L., “Where traditional DNA testing fails, algorithms take over,” published on ProPublica, Nov. 4, 2016, located at <https://www.propublica.org/article/where-traditional-dna-testing-fails-algorithms-take-over> (last accessed Dec. 12, 2017.)

Finally, as to the fourth prong of *Daubert*, the LR methodology is not generally accepted in the scientific community. The *Bonds* case involved a statistical calculation as well, but unlike in *Bonds*, here the existence and maintenance of standards controlling the technique's operations are not generally accepted such that it would be "implicit that the rate of error is acceptable to the scientific community as well." *Bonds, supra*, 12 F.3d at 565. In fact, the PCAST report and the NIST study demonstrate that the scientific community does not accept the potential error rate inherent in this methodology. Experts in the field are openly questioning whether "the DNA results were based on scientifically valid principles and derived from scientifically valid procedures" *id.* at 564, and the "absence of consensus is not immaterial." *Id.* at 562.

The decision in *Bonds* differs from this case on account of several critical factors. *Bonds, supra*, 12 F.3d 540. First, that case involved manually and visually interpreting DNA markers of a ***single-source sample of blood*** using RFLP, a process which MSP itself notes typically required "a considerable amount of DNA (approximately 500 ng) from the crime scene" to obtain a result. *Bonds, supra*, 12 F.3d at 550. (Attachment 14, MSP STRMix Validation Summary, p 3.) However, at issue in the instant case is a ***multiple-source sample*** from potentially three contributors of touch DNA, not blood. (Attachment 8, MSP Report 2.) Furthermore, a much smaller amount of DNA was examined here – only about 7.96 ng of DNA was in the sample. (Attachment 5, MSP Worksheet.) Thus, unlike in *Bonds*, the analysis here required amplification (copying) of the sample, a process that can result in artifacts that can affect the quality of the STRMix analysis. (Attachment 14, MSP STRMix Validation Summary, p 32.) Also, capillary electrophoresis, the process used to analyze the DNA sample taken from the gun in this case, is an automated process using a genetic analyzer that does not involve first-hand visual interpretation like the RFLP. (Attachment 5, MSP Worksheet.) *See Bonds, supra*, 12 F.3d at 550.

Perhaps most important, the statistical tool used in *Bonds* is wholly distinguishable from the statistical operation utilized in this case. In *Bonds*, the government determined the random-match probability, or the frequency of the single profile present in the sample in that case with respect to the population at large, using the product rule. *Bonds, supra*, 12 F.3d at 550. But samples containing multiple contributors cannot rely on the application of this simple principle because, as the PCAST report indicates, it often is impossible to determine “how many separate individuals contributed to the mixture, let alone accurately to infer the DNA profile of each individual.” (Attachment 17, PCAST, pp 75-76.) Thus, programs like STRMix apply complex statistical algorithms to calculate the likelihood that a particular person, as opposed to a random person, is present in the mixture. But algorithmic analysis programs like STRMix are a new frontier of DNA science, and as the PCAST report concluded, the validity of this software has been established only in certain circumstances not present here, and additional, *independent*, research is critically needed. (Attachment 17, PCAST, p 76.) A known technique that has drawn only minimal support within community may properly be viewed with skepticism. *Daubert, supra*, 509 U.S. at 594. The underlying principles and methodology used here to make the statistical probability estimate are not scientifically valid in that they do not “result from sound and cogent reasoning,” but rather subjective belief. *Bonds, supra*, 12 F.3d at 565.

Because of the subjective principles upon which it relies, submission of the LR here would only marginally help the trier of fact to understand the evidence, while creating an enormous possibility of unfair prejudice and confusion of the issues. FRE 403. According to the American Psychology Association, research has demonstrated that “people generally aren’t very good at interpreting probabilities, and they are easily swayed by the way statistics are presented.”²²

²² Article, “The problem with DNA,” American Psychological Association, June 2007 Monitor on Psychology, Vol. 38, No. 6, p. 52 (June 2007), located at <http://www.apa.org/monitor/jun07/problem.aspx> (last accessed Dec. 15, 2017)

Furthermore, “[j]urors often get too much information, and not enough instruction on how to analyze it.”²³ For instance, as a 2007 article by the APA explains:

Since everyone’s DNA—except that of identical twins—is unique, the chance of a coincidental match is often around one in 10 billion, which sounds really impressive, given that the population of the earth is about 6.5 billion. But one in 10 billion is a statistical probability of coincidence—not proof that only one person on the earth could have this profile. What’s more, that number does not factor in other potential problems, such as lab errors[.]

In the courtroom, jurors tend to think that match statistics such as one in a billion cover all possibilities for error, but they only refer to one area, such as the chance of a coincidental match, and there are other mitigating factors such as the chances of a false match[.]²⁴

Here, the LR incorporates an astronomically high number – “49 Million times more likely” – that is likely to make a powerful impact on a juror’s perception of the DNA evidence. (Attachment 10, MSP Report 3.) Yet the underlying assumptions upon which this figure is based implicate proprietary and extraordinarily complex theories of statistical calculus to which even trained MSP analysts cannot expertly speak. FRE 703. Even “vigorous cross-examination and careful instruction on the burden of proof” would be insufficient to attack this evidence, because “clear and effective presentation to jury” is impossible. *Daubert, supra*, 509 U.S. at 596. The danger that a jury will place too much stock in the LR of “49 Million times more likely” is great. This evidence should not be disclosed to the jury because its probative value is substantially outweighed by the prejudicial effect. FRE 403.

(Attachment 27).

²³ Article, “The problem with DNA,” American Psychological Association, June 2007 Monitor on Psychology, Vol. 38, No. 6, p. 52 (June 2007), located at <http://www.apa.org/monitor/jun07/problem.aspx> (last accessed Dec. 15, 2017).

²⁴ Article, “The problem with DNA,” American Psychological Association, June 2007 Monitor on Psychology, Vol. 38, No. 6, p. 52 (June 2007), located at <http://www.apa.org/monitor/jun07/problem.aspx> (last accessed Dec. 15, 2017).

- C. The LR generated by MSP's application of STRMix is unreliable and should not be admitted because large gaps in the chain of custody and the lack of adherence to stringent handling procedures call into question the integrity of the material subjected to analysis, and therefore the results of all subsequent tests.

Under FRE 609, “[t]o satisfy the requirement of authenticating or identifying an item of evidence, the proponent must produce evidence sufficient to support a finding that item is what the proponent claims it is.” FRE 609. Challenges to the chain of custody normally go to the weight of the evidence, not its admissibility. *United States v. Granderson*, 651 Fed. Appx. 373 (6th Cir. 2016). However, if the possibilities of misidentification or alteration cannot be eliminated “as a matter of reasonable probability,” then the evidence is inadmissible. *See United States v. McFadden*, 458 F.2d 440, 441 (6th Cir. 1972) (period of time between a bank robbery and the arrival of police was a “very brief interval” that sufficiently laid a foundation for admission of a bank note), *United States v. Williams*, 640 Fed. Appx. 492 (6th Cir. 2016).

The average human sheds approximately 400,000 skin cells daily. (Attachment 19, Wickenheiser, et. al., “Trace DNA: A Review, Discussion of Theory, and Application of the Transfer of Trace Quantities of DNA Through Skin Contact,” Vol 47, Issue 3, 441-450, p 445, *Journal of Forensic Sciences*, ASTM International, 2002.) Studies have shown that transfer of DNA from one individual to another and subsequently to an object is possible. (Attachment 20, Lowe, et. al, “The propensity of individuals to deposit DNA and secondary transfer of low level DNA from individuals to inert surfaces,” *Forensic Science International* 129 (2002) 25-34 (“FSI 129”), p 25.) “[W]hen people are under the same roof there are multiple opportunities for transfer, from handling each other’s laundry to touching the same objects.” (Attachment 21, Article, “DNA in the dock: how flawed techniques send innocent people to prison,” *The Guardian*, October 3, 2017.) But “trace DNA is often far from conclusive, with analysts having to turn to statisticians

to unpick mixed profile.” (Attachment 21, Article, “DNA in the dock: how flawed techniques send innocent people to prison,” The Guardian, October 3, 2017.)

The amount of original deposit will vary significantly depending on substrate (object material type), manner of contact, whether the person is a good shedder, and freshness of deposit. (Attachment 16, FSI 129, p 25.) One study of secondary transfer concluded that in 20% of findings, the degree of secondary transfer *exceeded* the level of primary transfer in the same sample. (Attachment 22, Davies, et. al, “Assessing primary, secondary and tertiary DNA transfer using the Promega ESI-17 Fast PCR chemistry,” Forensic Science International: Genetics Supplement Series 5 (2015) e55-e57 (“FSI GSS 5”), p e56.) However, it is usually impossible to determine when the DNA was transferred to the item. (Attachment 16, FSI 129, p 25.)

Today, PCR can “detect DNA at levels hundreds or even thousands of times lower than when DNA fingerprinting was developed in the 1980s.” (Attachment 23, Douglas Starr, “Forensics gone wrong: When DNA snares the innocent,” Science Magazine, Mar. 7, 2016, p 3.) Thus, “touch DNA” from fingerprints comprising only 25 to 30 cells will sometimes suffice. (Attachment 23, Douglas Starr, “Forensics gone wrong: When DNA snares the innocent,” Science Magazine, Mar. 7, 2016, p 3.) Therefore, careful and traceable handling of evidence is critical to good science and reliable results. As the NRC stated in its second report, issued in 1996:

Even the strongest evidence will be worthless – or worse, could lead to a false conviction – if the evidence sample did not originate in connection with the crime. Given the great individuating potential of DNA evidence and *the relative ease with which it can be mishandled* or manipulated by the careless or the unscrupulous, *the integrity of the chain of custody is of paramount importance.*

Attachment 24, NRC II, p 25 (emphasis added).²⁵

²⁵ The NRC II report set forth several safeguards against mishandling of samples, including recommending submission of complete evidence items, rather than clippings or scrapings, to the laboratory. *See id.* at p 81. In the instant case, the complete evidence item – that is, the firearm – was not submitted to the MSP laboratory.

Significantly, as observed by the American Psychological Association (“APA”), “[j]uries sometimes gloss over the possibility of lab mistakes and mixed evidence . . . which can all lead to false positives and land innocent people in prison.”²⁶ Moreover, the APA cautioned:

Errors are more common when the DNA is “mixed,” meaning from more than one person or the evidence is degraded by time or improper storage[.] . . . Then experts must try to separate out the different sources. The people who are sorting all of this out often know who is supposed to “match,” which can influence the process.²⁷

Here, the materials provided to the defense strongly suggest that the evidence, collected from a locked cabinet in a home that Mr. Gissantaner shared with several other individuals, was potentially mishandled and therefore possibly contaminated.

First, at least one, possibly two, officers can be heard, on the recording from Officer Kidney’s body camera, admitting to having moved the firearm prior to the arrival of the forensic technician, contrary to instruction he had received. (Kidney MVR 200856 at 58:23.) Specifically, the unidentified officer then continues, “[i]t’s a problem ‘cause I touched it and I moved it and I know Olsen always tells me, ‘If you find something, just leave it there.’” (Kidney MVR 200856 at 58:23.) During the time he was thoroughly searching Mr. Gissantaner’s home on September 25, 2015, this same officer could have come into contact with dozens – even hundreds – of locations where he could have inadvertently picked up some of Mr. Gissantaner’s DNA, which he then in all likelihood transferred to the firearm that he touched. The reality that the only item of physical evidence in this case was altered from its original state cannot be eliminated “as a matter of reasonable probability.” *McFadden*, *supra*, 458 F.2d at 441.

²⁶ Article, “The problem with DNA,” American Psychological Association, June 2007 Monitor on Psychology, Vol. 38, No. 6, p. 52 (June 2007), located at <http://www.apa.org/monitor/jun07/problem.aspx> (last accessed Dec. 15, 2017).

²⁷ Article, “The problem with DNA,” American Psychological Association, June 2007 Monitor on Psychology, Vol. 38, No. 6, p. 52 (June 2007), located at <http://www.apa.org/monitor/jun07/problem.aspx> (last accessed Dec. 15, 2017).

Also, the discovery materials do not identify the methods by which the evidence was stored or transported by the BCPD evidence technician, Officer Rathjen, once he arrived at the scene. Again, the government cannot demonstrate that the firearm was ever in contact with any other individual or object that had Mr. Gissantaner's DNA. With touch DNA, this fact is vitally important, because analysts can detect DNA that was "transferred from one person to another by way of an object both of them have touched, or from one piece of evidence to another by crime scene investigators, lab techs – or when two items jostled against each other in an evidence bag." (Attachment 23, Douglas Starr, "Forensics gone wrong: When DNA snares the innocent," Science Magazine, Mar. 7, 2016, p 3.)

A break in the chain of custody also contributes to the probability that the firearm and DNA from Mr. Gissantaner could have come into contact with each other without direct contact. Specifically, the location of the firearm and the buccal swab collected from Mr. Gissantaner by Officer Rathjen are unaccounted for from September 25, 2017, to September 30, 2017. This is not a "very brief interval" of time, such as the period of time between a bank robbery and the arrival of police. *See McFadden, supra*, 458 F.2d at 441. And the conditions of the storage – temperature, vessel, etc. – of these items containing highly sensitive biological samples are not described in the materials provided to the defense. Either the firearm or the swabs from the firearm, the crucial pieces of evidence in this case, could have been, for example, out in the open, on a table in the police department, or in the back of a police car, potentially commingling with items with which Mr. Gissantaner's DNA had come into contact.

Additionally, BCPD's failure to adhere to the protocol for the collection of DNA calls the integrity of all this evidence into serious question. First, MSP's DNA profiling system policies set forth the requirements for an agency to collect DNA samples. Its policies state, in pertinent part:

(4) Each designated agency shall determine if a DNA sample is already on file for the offender through the criminal history record. DNA samples ***shall not be collected when the criminal history record indicates a DNA sample has previously been obtained from the offender.***

Attachment 25, Michigan State Police DNA Profiling System (“MSP DNA Profiling System”) R 28.5053(4) (emphasis added).

Here, the defendant submits that his DNA was already on file, due to his previous criminal history. Because Mr. Gissantaner’s DNA sample already was on file, the collection of his DNA was prohibited by MSP policy. (Attachment 25, MSP DNA Profiling System, R 28.5053(4).) In other words, the risk of contamination of the gun swab by Mr. Gissantaner’s DNA during collection, storage, and processing appears to have been unnecessarily created by BCPD’s violation of MSP policies for agencies collecting DNA for analysis. Nor can the defense attempt to eliminate the possibility of alteration of the sole piece of physical evidence in this case by referring to BCPD’s own procedures for handling DNA evidence – because such procedures do not exist, at least not in written form. Namely, when the defense requested from BCPD a copy of such manuals and policies through subpoena, no such materials were produced.

Analogously, MSP sets forth detailed policies on handling biological material, requiring, for example, laboratory coats, gloves, and a face mask to be worn at all times during the handling of biological evidence, preparing materials to be used in analysis, “or in the immediate vicinity of these activities.” (Attachment 12, MSP PMBIO 2.1.2.2.) Gloves must be changed frequently, and analysts engaging in PCR testing are specifically advised to “change gloves frequently ***to avoid casual transfer of sample.***” (Attachment 12, MSP PMBIO, 2.1.5.2.6 (emphasis added).) Additionally, all analyses must be performed on a clean work surface cleaned with 10% bleach solution or on disposable bench paper. (Attachment 12, MSP PMBIO 2.1.2.4.) All work surfaces must be cleaned with 10% bleach solution after each use. (Attachment 12, MSP PMBIO,

2.1.5.2.7.) With respect to conditions of storage, MSP requires DNA extracts be stored at 4 degrees Celsius overnight and -20 degrees Celsius for longer periods. (Attachment 12, MSP PMBIO, 2.1.7, 2.12.2.) When transfer of the product from one area to another is required, the material must be in a containment vessel that has been wiped down with 10% bleach solution. (Attachment 12, MSP PMBIO 2.1.7.) All controls must be documented. (Attachment 12, MSP PMBIO 2.1.3.2.)

The detailed policies in place at MSP's laboratories appear to heed the NRC's urging with respect to the need for standard procedures for the collection and preservation of evidence. Not surprisingly, on March 9, 2017, MSP's laboratories were determined to be in compliance with the FBI's Quality Assurance Standards. (Attachment 26, Letter from FBI to Kristin Schelling, Michigan State Police, Forensic Science Division, March 9, 2017.) However, although BCPD likewise handled this physical evidence, BCPD has no published standard handling procedures, nor do the materials they have indicate that stringent care to protect the integrity of the evidence was used in handling the evidence. In fact, the statements made by the officers, captured by the body camera recording, and the abbreviated summary of the DNA collection tend to suggest the opposite. (Kidney MVR 200856 at 58:23; Long MVR 200863 at 49:30.) Namely, the weapon was handled by apparently two officers who, prior to touching the evidence, had been exhaustively searching a home in which Mr. Gissantaner lived, and throughout which his DNA was present. One of these officers even sheepishly admits to another officer that he had handled the evidence contrary to his instruction. (Kidney MVR 200856 at 58:23.) Finally, the handling of the evidence is also problematic in light of its disposition: although the MSP chain of custody indicates it returned Mr. Gissantaner's cheek swabs to the BCPD, these complete swabs were not present when the defense visited the evidence on October 2, 2017. (Attachment 4, MSP COC.)

For the defendant to have a fair trial, the jury must have an opportunity to follow every step of the DNA processing, from its collection, to its packaging, to its storage, to its transfer, and to its analysis, to determine whether the results of the STRMix analysis are reliable. Here, the lack of a complete and detailed chain of custody renders it impossible to ascertain whether the gun was contaminated by the defendant's DNA through inadvertent means. As set forth in section II of this brief, the content and integrity of the DNA material subjected to the PCR process directly affect the discretionary decisions made by the analysts and technicians with respect to what type and amount of alleles are present, as well as the number of individual contributors of DNA. In turn, STRMix relies upon these subjective determinations for calculating the LR, which then is offered to the jury as "proof" of the defendant's guilt. The condition of the physical evidence, and therefore the results of the DNA analysis and the STRMix analysis, lack integrity because of the failure of BCPD officers to adhere to stringent rules of care regarding handling of sensitive DNA material.

IV. CONCLUSION AND RELIEF REQUESTED

For the reasons set forth in the arguments above, the defendant respectfully requests that the Court enter an order excluding all results of DNA testing in this case because they are unreliable and unfairly prejudicial.

WHEREFORE, the defendant, Daniel Gissantaner, respectfully requests this Court grant this motion to exclude evidence.

Respectfully submitted,

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